Injection Kicker Ceramic Chamber Impedance SDH 8/21/01
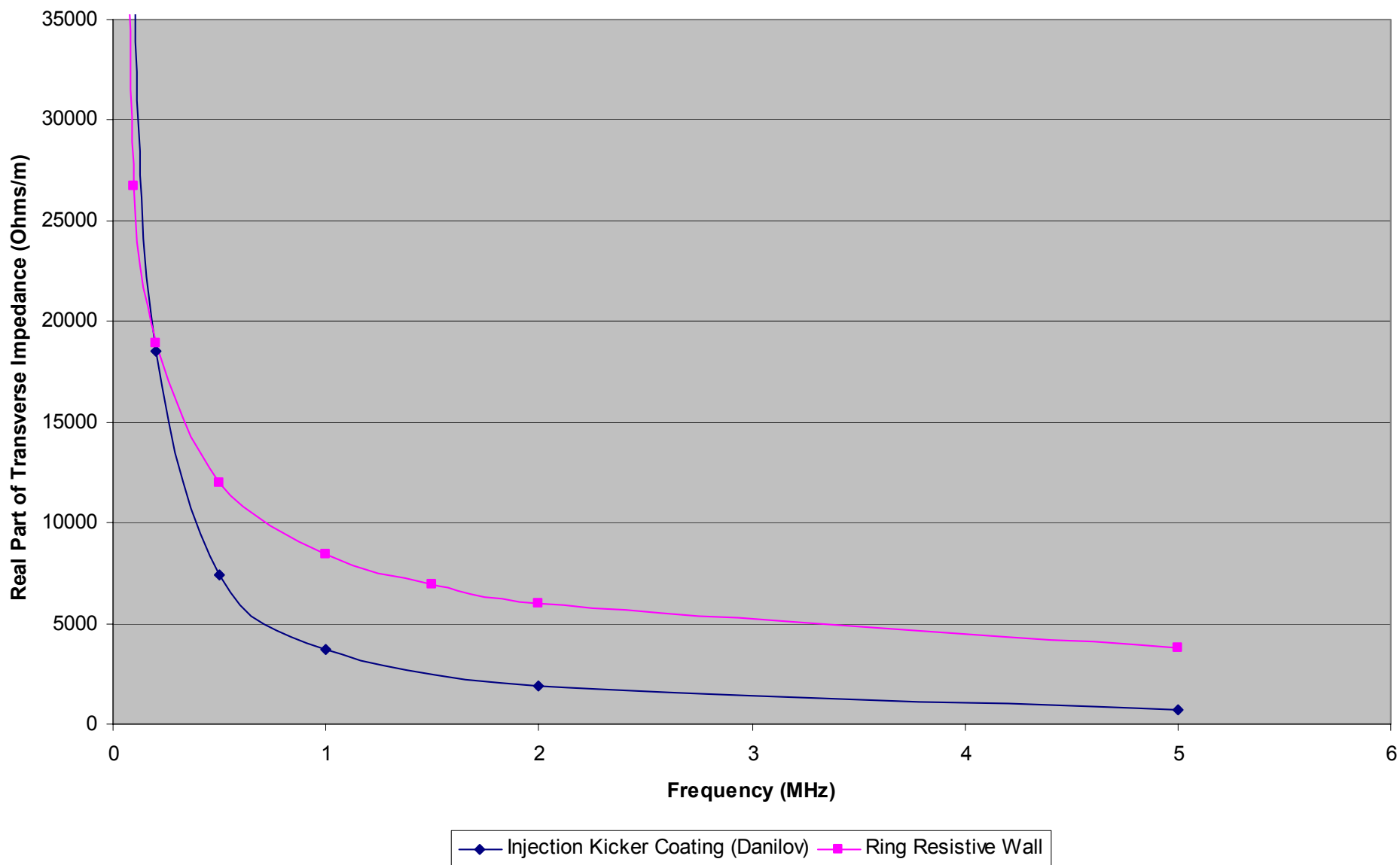
- **Since last meeting:**
  - Would like to retain ability to pulse injection kickers with τ=200 μs exponential if P.S. can do it.
  - Revisit resistive-wall impedance of the ring using arc vacuum chamber profiles and collimator tubes (rest of ring is r=10 cm)
  - Explore the use of external conductors to reduce impedance at low frequency
  - Slava Danilov finds that the impedance at very low frequencies (1 kHz) might be important for closed-orbit stability
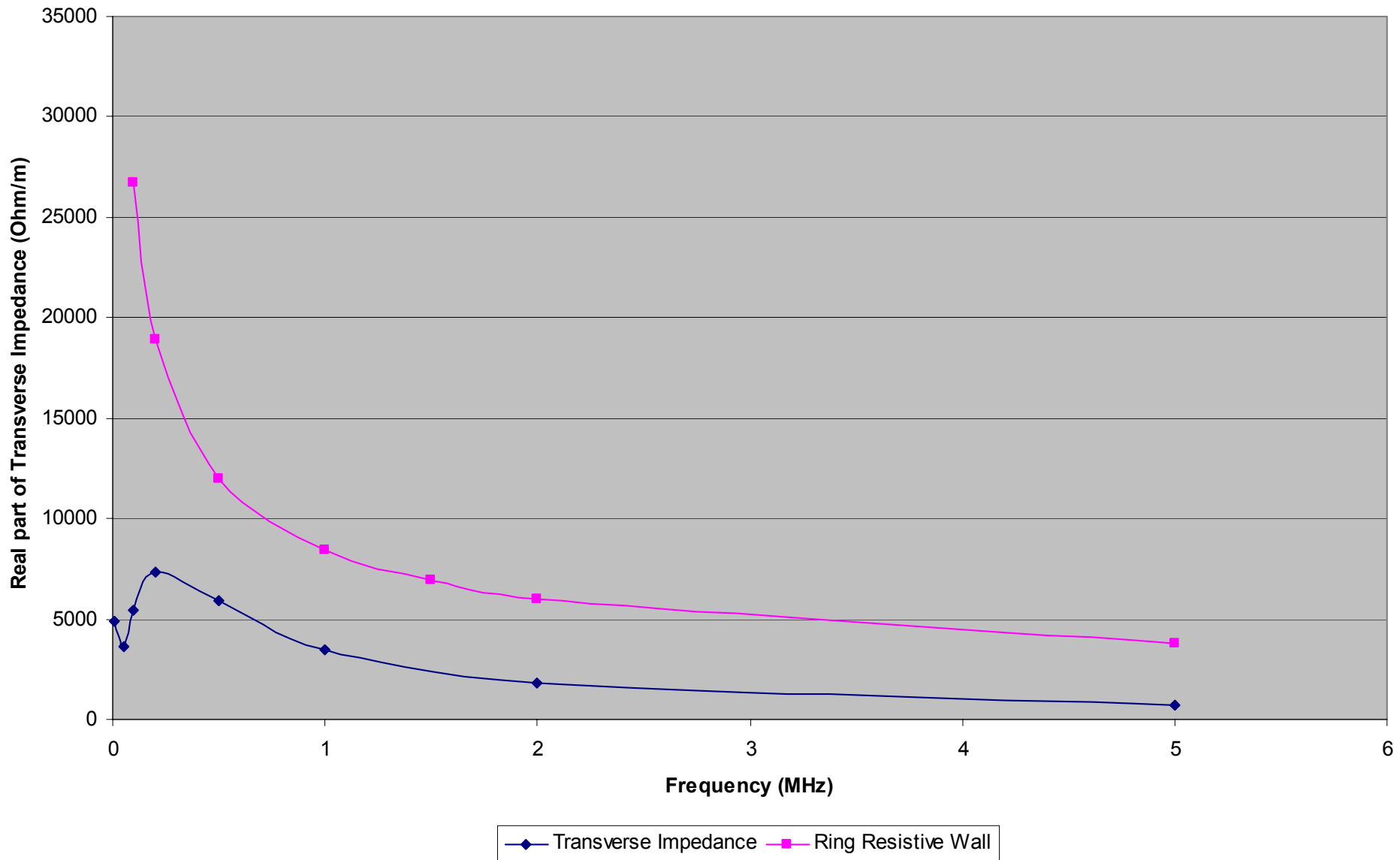
- **External Conductors:**
  - Could place a good conductor on the outside and actively cool the eddy-current power dissipation (25 micron Cu gives P=5.5 kW): **Impractical**
  - Could place a good conductor where eddy current loop is smallest, and thinner elsewhere: **RF shielding might not be very good**
  - Place thick conducting stripes on the **outer surface** and kill eddy currents with **blocking capacitors**
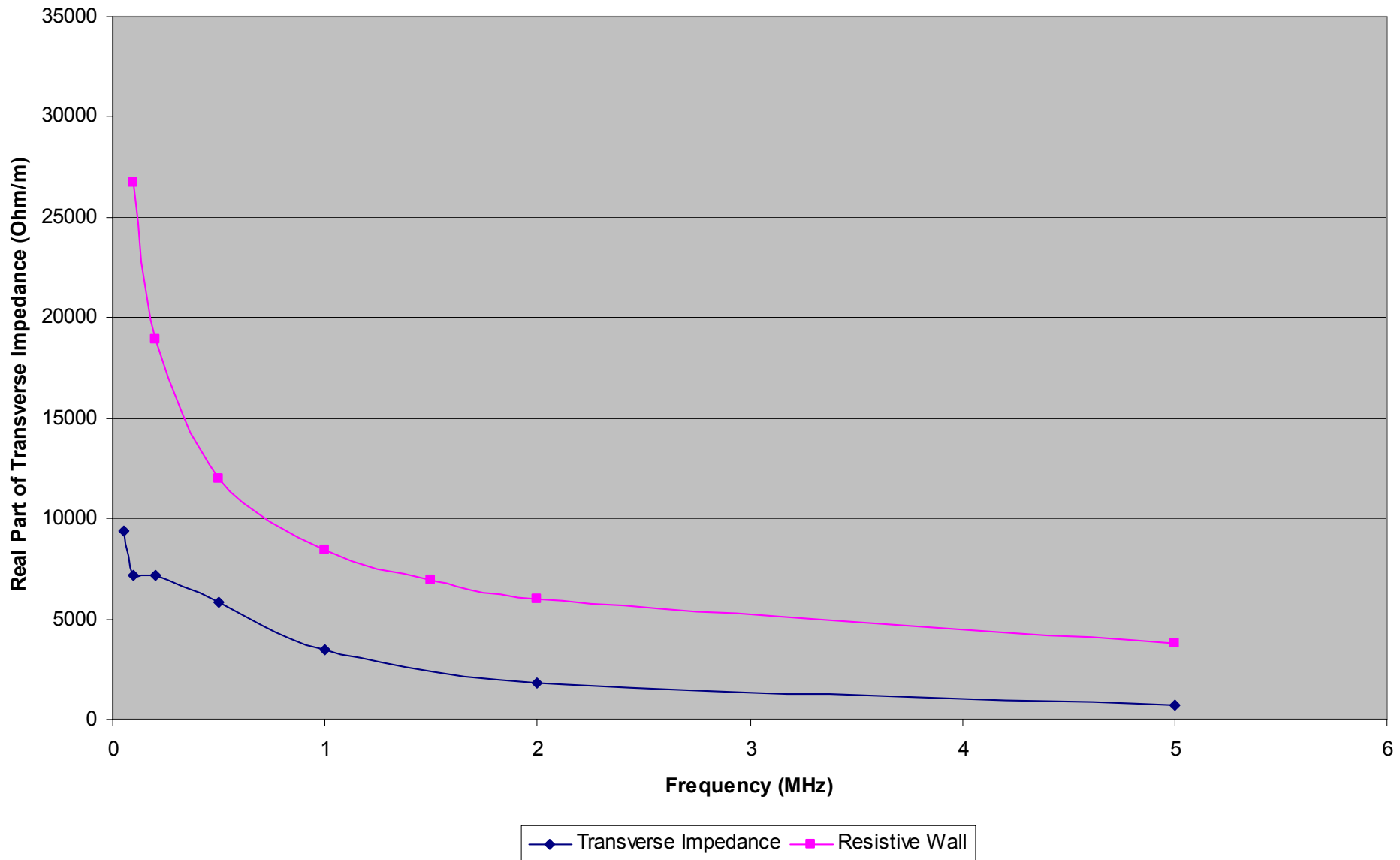
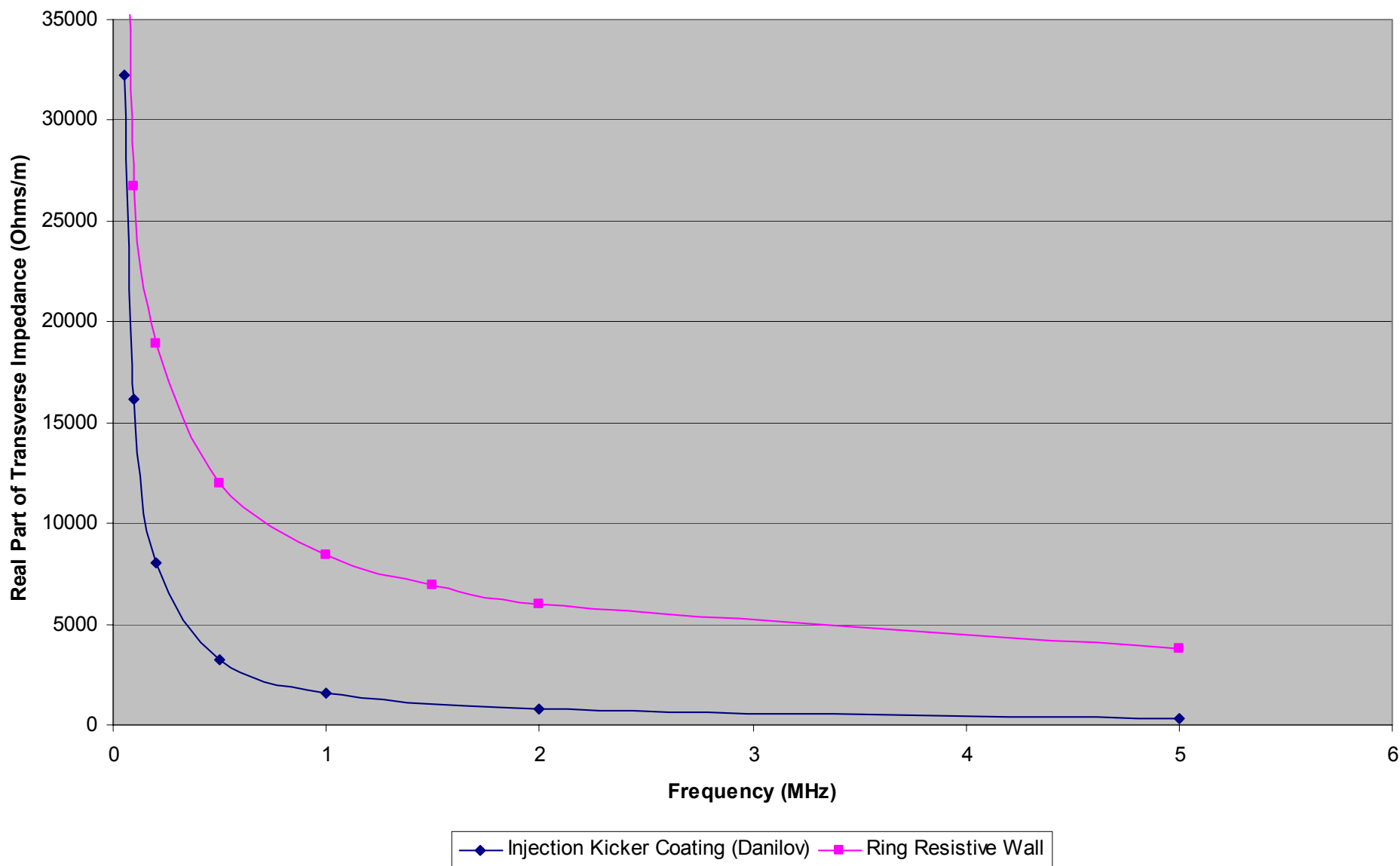**18 micron TiN coating - 100 W/m Eddy current**

Real Part of Transverse Impedance (Ohms/m) vs Frequency (MHz)

Injection Kicker Coating (Danilov) — Ring Resistive Wall

18 micron TiN, 50 micron Cu external conductor

18 micron TiN with 50 micron Cu stripes with 3 uF caps

Thick Gold Top and Bottom 100 W/m Eddy current

Real Part of Transverse Impedance (Ohms/m) vs Frequency (MHz)

Legend: ◆ Injection Kicker Coating (Danilov) ■ Ring Resistive Wall

Thick Gold Top and Bottom with 50 micron Cu stripes with 3 uF caps
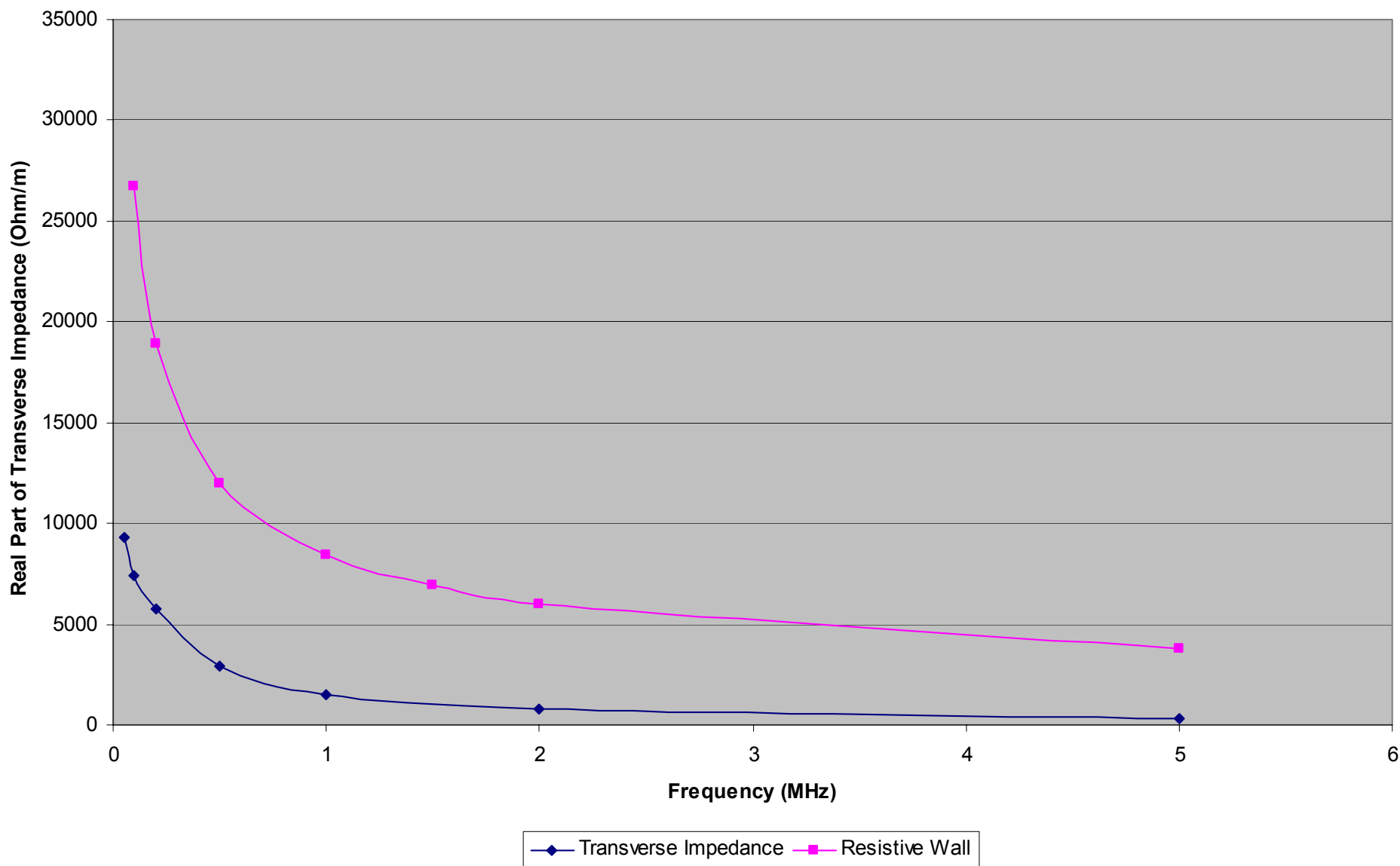
Issues Related to External Conducting Stripes

- How do we put a good conductor on the outside of the ceramic chambers?
  - 2 mil copper foil – attached?
  - Conductive pastes fired in an oven – may need to do before Kovar flanges attached to ceramics
  - Conductor loaded paint (Au/Pt)
- Need discrete caps which handle radiation (ISIS experience)
- How do we make electrical connection to a stripe?

Conclusion and a Question

- External conductor reduces impedance below about 500 kHz. At low frequency reduction is very large.

- We should pursue this approach and come up with a practical solution.

- Need to understand low-frequency impedance requirements.

- Need to further optimize parameters of external conductor.

- The only way to reduce impedance above about 500 kHz is with thicker internal coating.

- Thermal analysis assumed natural air convection. Can we build in at this stage forced air convection? 3 ft/sec air flow cuts ΔT in half.

- If so, we could put even thicker coating on inside.